conversion between equivalent networks. Multistage switching networks in the bit-permuting type and banyan-type can be classified into equivalence classes. One network can usually be replaced by another equivalent network in certain applications. This widens the choices of networks in meeting different requirements in applications.--.

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In the Claims:

Please cancel claims 1-39.

Please add claims 40-78 as follows:

--40. A method for configuring an equivalent $2^n \times 2^n$ k-stage bit-permuting network based on a given $2^n \times 2^n$ k-stage bit-permuting network having the representation $[\sigma_0 : \sigma_1 : \sigma_2 : \ldots : \sigma_{k-1} : \sigma_k]_n$, the method comprising

specifying a permutation κ on integers from 1 to n that preserves n, and

implementing the equivalent network as $[\sigma_0 : \sigma_1 : \ldots : \sigma_{j-1}\kappa : \kappa^{-1}\sigma_j : \ldots : \sigma_k]_n$, $j = 1, 2, \ldots,$ or k.

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41. The method as recited in claim 40 wherein the given network is a banyan-type network and the equivalent network is a banyan-type network.

42. A method for configuring an equivalent $2^n \times 2^n$ k-stage bit-permuting network based on a given $2^n \times 2^n$ k-stage bit-permuting network having the representation $[\sigma_0 : \sigma_1 : \sigma_2 : \ldots : \sigma_{k-1} : \sigma_k]_n$, the method comprising

specifying permutations $\kappa_1, \kappa_2, \ldots, \kappa_k$ on integers from 1 to n that preserve n, and

implementing the equivalent network as $[\sigma_0\kappa_1 : \kappa_1^{-1}\sigma_1\kappa_2 : \kappa_2^{-1}\sigma_2\kappa_3 : \ldots : \kappa_{k-1}^{-1}\sigma_{k-1}\kappa_k : \kappa_k^{-1}\sigma_k]_n$.

43. The method as recited in claim 42 wherein the given network is a banyan-type network and the equivalent network is a banyan-type network.

44. A method for configuring an equivalent $2^n \times 2^n$ bit-permuting network based on a given $2^n \times 2^n$ bit-permuting network composed of stages and exchanges, the method comprising

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identifying one stage from the stages of the given network, the identified stage having a preceding exchange immediately before it and a succeeding exchange immediately after it,

specifying a permutation on the integers 1 to n that preserves n,

rearranging the preceding exchange and the succeeding exchange with reference to the permutation to generate a rearranged preceding exchange and a rearranged succeeding exchange, respectively, and

implementing the equivalent network so that a stage in the equivalent network corresponding to the identified stage has the rearranged preceding exchange and the rearranged succeeding exchange.

45. The method as recited in claim 44 wherein the permutation, denoted as κ, induces a $2^n \times 2^n$ cell rearrangement X_κ, and the rearranging includes multiplying the preceding exchange by X_κ from the right-hand side to produce the rearranged preceding

exchange and multiplying the succeeding exchange by $X_{\kappa^{-1}}$ from the left-hand side to produce the rearranged succeeding exchange.

46. The method as recited in claim 45 wherein the given network has k-stages, the given network has the representation $[\sigma_0 : \sigma_1 : \sigma_2 : \ldots : \sigma_{k-1} : \sigma_k]_n$, the identified stage is stage j, and the equivalent network is of the form $[\sigma_0 : \sigma_1 : \ldots : \sigma_{j-1}\kappa : \kappa^{-1}\sigma_j : \ldots : \sigma_k]_n$, $j = 1, 2, \ldots$, or k.

47. The method as recited in claim 44 wherein the given network is a banyan-type network and the equivalent network is a banyan-type network.

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48. A method for configuring an equivalent $2^n \times 2^n$ bit-permuting network by cell rearrangement based on a given $2^n \times 2^n$ bit-permuting network composed of stages and exchanges, the method comprising

identifying one stage from the stages of the given network, the identified stage having a preceding exchange and a succeeding exchange,

specifying a permutation, denoted as κ, on the integers 1 to n that preserves n and induces a $2^n \times 2^n$ cell rearrangement X_κ,

rearranging the preceding exchange of the identified stage by multiplying the preceding exchange with X_κ from the right-hand side to produce a rearranged preceding exchange and rearranging the succeeding exchange of the identified stage by multiplying the succeeding exchange by $X_{\kappa^{-1}}$ from the left-hand side to produce a rearranged succeeding exchange, and

implementing the equivalent network so that a stage in the equivalent network corresponding to the identified stage has the rearranged preceding exchange and the rearranged succeeding exchange.

49. A method for cell rearrangement of a $2^n \times 2^n$ bit-permuting network composed of stages and exchanges, the method comprising

selecting one stage from the stages of the given network to identify a preceding exchange and a succeeding exchange,

specifying a permutation, denoted as κ, on the integers 1 to n that preserves n and induces a $2^n \times 2^n$ cell rearrangement X_κ, and

multiplying the preceding exchange with X_κ from the right-hand side to implement a rearranged preceding exchange and multiplying the succeeding exchange by $X_{\kappa^{-1}}$ from the left-hand side to implement a rearranged succeeding exchange.

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50. A method for cell rearrangement of a given stage of a $2^n \times 2^n$ bit-permuting network composed of stages and exchanges, the method comprising

specifying a permutation, denoted as κ, on the integers 1 to n that preserves n and induces a $2^n \times 2^n$ cell rearrangement X_κ, and

multiplying the preceding exchange immediately before the given stage by X_κ from the right-hand side to implement a rearranged preceding exchange for the given stage and multiplying the succeeding exchange immediately after the given stage exchange by $X_{\kappa^{-1}}$ from the left-hand side to implement a rearranged succeeding exchange for the given stage.

51. A method for rearranging a given $2^n \times 2^n$ bit-permuting network having the representation $[\sigma_0 : \sigma_1 : \sigma_2 : \ldots : \sigma_{k-1} : \sigma_k]_n$ to an equivalent $2^n \times 2^n$ bit-permuting network having the representation $[\pi_0 : \pi_1 : \pi_2 : \ldots : \pi_{k-1} : \pi_k]_n$, the method comprising

determining permutations $\kappa_1, \kappa_2, \ldots, \kappa_k$ on integers from 1 to n that preserve n, and

implementing the equivalent network with exchanges determined from $\pi_1 = \kappa_1^{-1}\sigma_1\kappa_2, \pi_2 = \kappa_2^{-1}\sigma_2\kappa_3, \ldots, \pi_{k-1} = \kappa_{k-1}^{-1}\sigma_{k-1}\kappa_k$ so that the equivalent network can be further expressed as $[\alpha : \kappa_1^{-1}\sigma_1\kappa_2 : \kappa_2^{-1}\sigma_2\kappa_3 : \ldots : \kappa_{k-1}^{-1}\sigma_{k-1}\kappa_k : \beta]_n$ for some permutations α and β.

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52. The method as recited in claim 51 wherein the input exchange α of the equivalent network is equal to π_0.

53. The method as recited in claim 51 wherein the output exchange β of the equivalent network is equal to π_k.

54. The method as recited in claim 51 wherein the input exchange α of the equivalent network is equal to π_0 and the output exchange β of the equivalent network is equal to π_k.

55. A method for configuring a given $2^n \times 2^n$ k-stage bit-permuting network to

achieve a desired trace, the method comprising

determining a permutation σ on the integers 1 to n that maps the trace of the given network term-by-term to the desired trace, and

prepending the given network with an extra input exchange induced by σ^{-1} if the permutation σ exists.

56. A method as recited in claim 55 wherein $k = n$ and the bit-permuting network is a $2^n \times 2^n$ banyan-type network.

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57. A method as recited in claim 55 wherein the trace of the given network is the sequence $t_1, t_2, \ldots, t_k$, the desired trace is the sequence $t'_1, t'_2, \ldots, t'_k$, and $t'_j = \sigma(t_j)$ for $j = 1, 2, \ldots, k$.

58. A method for configuring a given $2^n \times 2^n$ k-stage bit-permuting network to achieve a desired guide, the method comprising

determining a permutation π on the integers 1 to n that maps the guide of the given network term-by-term to the desired guide, and

appending the given network with an extra output exchange induced by π if the permutation π exists.

59. A method as recited in claim 58 wherein $k = n$ and the bit-permuting network is a $2^n \times 2^n$ banyan-type network.

60. A method as recited in claim 58 wherein the guide of the given network is the sequence $g_1, g_2, \ldots, g_k$, the desired guide is the sequence $g'_1, g'_2, \ldots, g'_k$, and $g'_j = \pi(g_j)$ for $j = 1, 2, \ldots, k$.

61. A method for configuring a given $2^n \times 2^n$ k-stage bit-permuting network to achieve a desired trace and a desired guide, the method comprising

determining a permutation σ on the integers 1 to n that maps the trace of the given network term-by-term to the desired trace,

determining a permutation π on the integers 1 to n that maps the guide of the given network term-by-term to the desired guide, and

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if both the permutations σ and π exist, prepending the given network with an extra input exchange induced by σ^{-1}, and appending the given network with an extra output exchange induced by π.

62. A method as recited in claim 61 wherein $k = n$ and the bit-permuting network is a $2^n \times 2^n$ banyan-type network.

63. A method as recited in claim 61 wherein the trace of the given network is the sequence $t_1, t_2, \ldots, t_k$, the desired trace is the sequence $t'_1, t'_2, \ldots, t'_k$, and $t'_j = \sigma(t_j)$ for $j = 1, 2, \ldots, k$ and wherein the guide of the given network is the sequence $g_1, g_2, \ldots, g_k$, the desired guide is the sequence $g'_1, g'_2, \ldots, g'_k$, and $g'_j = \pi(g_j)$ for $j = 1, 2, \ldots, k$.

64. A method for rearranging a given $2^n \times 2^n$ banyan-type network having the

representation $[\sigma_0 : \sigma_1 : \sigma_2 : \ldots : \sigma_{n-1} : \sigma_n]_n$ to an equivalent $2^n \times 2^n$ banyan-type network having the representation $[\pi_0 : \pi_1 : \pi_2 : \ldots : \pi_{n-1} : \pi_n]_n$, the method comprising

determining permutations $\kappa_1, \kappa_2, \ldots, \kappa_n$ on integers from 1 to n that preserve n, and

implementing the equivalent network with exchanges determined from $\pi_1 = \kappa_1^{-1}\sigma_1\kappa_2, \pi_2 = \kappa_2^{-1}\sigma_2\kappa_3, \ldots, \pi_{n-1} = \kappa_{n-1}^{-1}\sigma_{n-1}\kappa_n$ so that the equivalent network can be further expressed as $[\alpha : \kappa_1^{-1}\sigma_1\kappa_2 : \kappa_2^{-1}\sigma_2\kappa_3 : \ldots : \kappa_{n-1}^{-1}\sigma_{n-1}\kappa_n : \beta]_n$ for some permutations α and β.

65. The method as recited in claim 64 wherein the input exchange α of the equivalent network is equal to π_0.

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66. The method as recited in claim 64 wherein the output exchange β of the equivalent network is equal to π_k.

67. The method as recited in claim 64 wherein the input exchange α of the equivalent network is equal to π_0 and the output exchange β of the equivalent network is equal to π_k.

68. A method for rearranging a first $2^n \times 2^n$ banyan-type network having the representation $[\sigma_0 : \sigma_1 : \ldots : \sigma_{n-1} : \sigma_n]$ with a first trace induced by a permutation τ on integers 1 to n and a first guide induced by a permutation γ on integers 1 to n to a second

$2^n \times 2^n$ banyan-type network having the representation $[\lambda\sigma_0 : \sigma_1 : \ldots : \sigma_{n-1} : \sigma_n\pi]$, the method comprising

prepending an additional input exchange X_λ to the first network, and

appending an additional output exchange X_π to the first network, wherein

the second network is characterized by a second trace induced by a permutation τ' on integers 1 to n and a second guide induced by a permutation γ' on integers 1 to n such that $\tau' = \tau\lambda^{-1}$ and $\gamma' = \gamma\pi$.

69. The method as recited in claim 68 wherein the permutations τ and γ that induce the first trace and the first guide are converted to any τ' and γ', respectively, with the prepended input exchange X_λ and the appended output exchange X_π by computing $\lambda = \tau'^{-1}\tau$ and $\pi = \gamma^{-1}\gamma'$.

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70. A method for configuring a given $2^n \times 2^n$ banyan-type network to achieve a desired trace wherein the trace of the given network is induced by a permutation τ on integers 1 to n, and the desired trace is induced by another permutation τ' on integers 1 to n, the method comprising

determining a permutation $\lambda = \tau'^{-1}\tau$, and

prepending the given network with an extra input exchange induced by λ.

71. A method as recited in claim 70 wherein the desired trace is 1, 2, …, n and the permutation $\lambda = \tau$.

72. A method as recited in claim 70 wherein the desired trace is n, n−1, ..., 1 and the permutation $\lambda = \sigma_{\leftrightarrow}^{(n)}\tau$.

73. A method for configuring a given $2^n \times 2^n$ banyan-type network to achieve a desired guide wherein the guide of the given network is induced by a permutation γ on integers 1 to n, and the desired guide is induced by another permutation γ' on integers 1 to n, the method comprising

determining a permutation $\pi = \gamma^{-1}\gamma'$, and

appending the given network with an extra output exchange induced by π.

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74. A method as recited in claim 73 wherein the desired guide is 1, 2, ..., n and the permutation $\pi = \gamma^{-1}$.

75. A method as recited in claim 73 wherein the desired guide is n, n−1, ..., 1 and the permutation $\pi = \gamma^{-1}\sigma_{\leftrightarrow}^{(n)}$.

76. A method for configuring a given $2^n \times 2^n$ banyan-type network to achieve a desired trace and a desired guide wherein the trace of the given network is induced by a permutation τ on integers 1 to n, the desired trace is induced by another permutation τ' on integers 1 to n, the guide of the given network is induced by a permutation γ on integers 1 to n, and the desired guide is induced by another permutation γ' on integers 1 to n, the method comprising

determining a permutation $\lambda = \tau'^{-1}\tau$,

determining a permutation $\pi = \gamma^{-1}\gamma'$,

prepending the given network with an extra input exchange induced by λ, and

appending the given network with an extra output exchange induced by π.

77. An equivalent $2^n \times 2^n$ k-stage bit-permuting network based on a given $2^n \times 2^n$ k-stage bit-permuting network having the representation $[\sigma_0 : \sigma_1 : \sigma_2 : \ldots : \sigma_{k-1} : \sigma_k]_n$, the equivalent network comprising

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permutation means for computing a permutation κ on integers from 1 to n that preserves n, and

a $2^n \times 2^n$ k-stage bit-permuting network configured as $[\sigma_0 : \sigma_1 : \ldots : \sigma_{j-1}\kappa : \kappa^{-1}\sigma_j : \ldots : \sigma_k]_n$, j = 1, 2, …, or k.

78. An equivalent $2^n \times 2^n$ k-stage bit-permuting network based on the j-th stage of a given $2^n \times 2^n$ k-stage bit-permuting network having the representation $[\sigma_0 : \sigma_1 : \sigma_2 : \ldots : \sigma_{k-1} : \sigma_k]_n$ and based on a permutation κ on integers from 1 to n that preserves n, the equivalent network comprising

an input exchange $\sigma_0\kappa$ if j=1, or an input exchange σ_0 if j = 2, 3, …, k,

an output exchange $\kappa^{-1}\sigma_k$ if j=k, or an output exchange σ_k if j =1, 2, …, k−1, and

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interstage exchanges $\sigma_1, \sigma_2, \ldots, \sigma_{j-1}\kappa, \kappa^{-1}\sigma_j, .., \sigma_{k-1}$ if $j = 2, \ldots,$ or $k-1$, or interstage exchanges $\kappa^{-1}\sigma_1, \sigma_2, \ldots, \sigma_j, \ldots, \sigma_{k-1}$ if $j = 1$, or interstage exchanges $\sigma_1, \sigma_2, \ldots, \sigma_j, .., \sigma_{k-2}, \sigma_{k-1}\kappa$ if $j = k$.--.